REMARKS

Claims 1-56 remain pending in the application, with claims 1-9, 28-36, 55-56 being treated on the merits. Claims 1-9, 28-36, 55-56 remain rejected under 35 U.S.C. § 103(a) as being unpatentable over Mooradian et al. (U.S. Patent No. 5,461,637) in view of Ishikawa et al. (U.S. Patent No. 6,359,919 B1) ("Ishikawa"). Applicants submit the following arguments to traverse the prior art rejections.

Applicants refer the Examiner to the detailed description of the Applicants' invention and the references in the Amendment of March 20, 2003.

Applicants submit that claims 1 and 28 are patentable because the claims recite that the first active layer of the semiconductor element is an InGaN material for emitting light in the 410 nm band, in combination with other elements. Nowhere in any of the references is there any teaching or suggestion of using InGaN material, as a ternary GaN material, as recited in the claims

Applicants submit that claims 1 and 28 are patentable because the Examiner has failed to establish a prima facie case of obviousness. There is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify Mooradian by having a first active layer made of a GaN-based compound as taught by Ishikawa. First, the Examiner is correct in that Mooradian discloses that "[p]referred substrate materials and quantum-well materials are, but not restricted to binary, ternary, or quaternary compounds taken from the Group III-V table of elements," (col. 5, lines 6-9). However, one skilled in the art would not have been led to use GaN specifically from Group III-V because of the structural differences with the active layer materials disclosed in Mooradian.

Moreover, the general teaching of Group III-V materials does not teach the more specific structure of the semiconductor as claimed. The Examiner is not free to assume interchanging of elements appropriate in Mooradian when specific combinations of GaAs and InP are discussed.

Further, Ishikawa teaches the use of a GaN substrate in a conventional semiconductor laser device, which is not a surface-emitting-type semiconductor laser device. On the other hand, claim 1 recites a surface-emitting semiconductor element having a GaN substrate.

The difference in the thermal conductivity of GaN and GaAs based materials show that one skilled in the art would not have used GaN with Mooradian. In Mooradian, the importance in the generation of heat in the semiconductor material in changing the refractive index of the semiconductor material is discussed:

> As the laser is pumped, the absorbed pump light causes heating of the semiconductor material and therefore a thermal lensing effect within the laser cavity. The thermal lens is caused by the thermally induced increase in refractive index or an actual physical bulging of the material surface due to thermal expansion. The thermal lens causes an effective mirror radius of curvature which is a function of absorbed pump power, size of the pumped spot, thermal conductivity of the material, heat sinking conditions, refractive index variation with temperature, and thermal expansion coefficient. (col. 1, lines 57-68; col. 3, lines 5-9).

As noted in the Amendment of March 20, 2003, GaN materials have a far larger thermal conductivity (130 W/m*K) than GaAs materials (45.8 W/m*K). As a consequence, the differences in thermal conductivity would necessarily change the principle of operation of Mooradian if GaN is used.

Claims 2-9, and 55, which depend from claim 1, and claims 29-36, and 56, which depend from claim 28, are patentable at least for the reasons submitted for the respective base claims.

Alternatively, or in addition, claims 55 and 56 are patentable because the claims recite structural features not found in the references, in combination or individually. Applicants submit that the Examiner has not shown how the claimed broad area type semiconductor laser is taught or suggested by the references.

Lastly, the invention as recited in claims 1 and 28 are patentable because of the following advantageous effects obtained by using the GaN substrate in the laser apparatus employing a surface-emitting semiconductor element:

1) Since the GaN substrate is transparent to the excitation laser light, it is possible to excite the surface-emitting semiconductor element through the substrate. Heat generated in the surface-emitting element can be easily dissipated. Further, beam deformation due to the thermal lens effect or the light is very small.

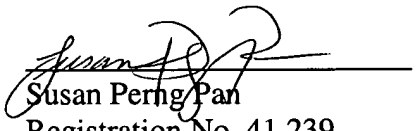
Since the excitation laser light is supplied to the surface-emitting semiconductor element through the substrate as shown in Fig. 8, the superposition of the oscillation mode and the excitation mode can be carried out well, whereby a good laser beam can be obtained without deformation.

2) Due to the surface-emitting semiconductor element, the laser apparatus can oscillate with high output power and without deterioration. Since generated heat can be easily dissipated by using the GaN substrate, a high output beam without deformation can be obtained. Further, since heat generation at the active layer can be suppressed, the lifetime of the laser apparatus can be made long (Specification, page 6, line 23 - page 7, line 9).

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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